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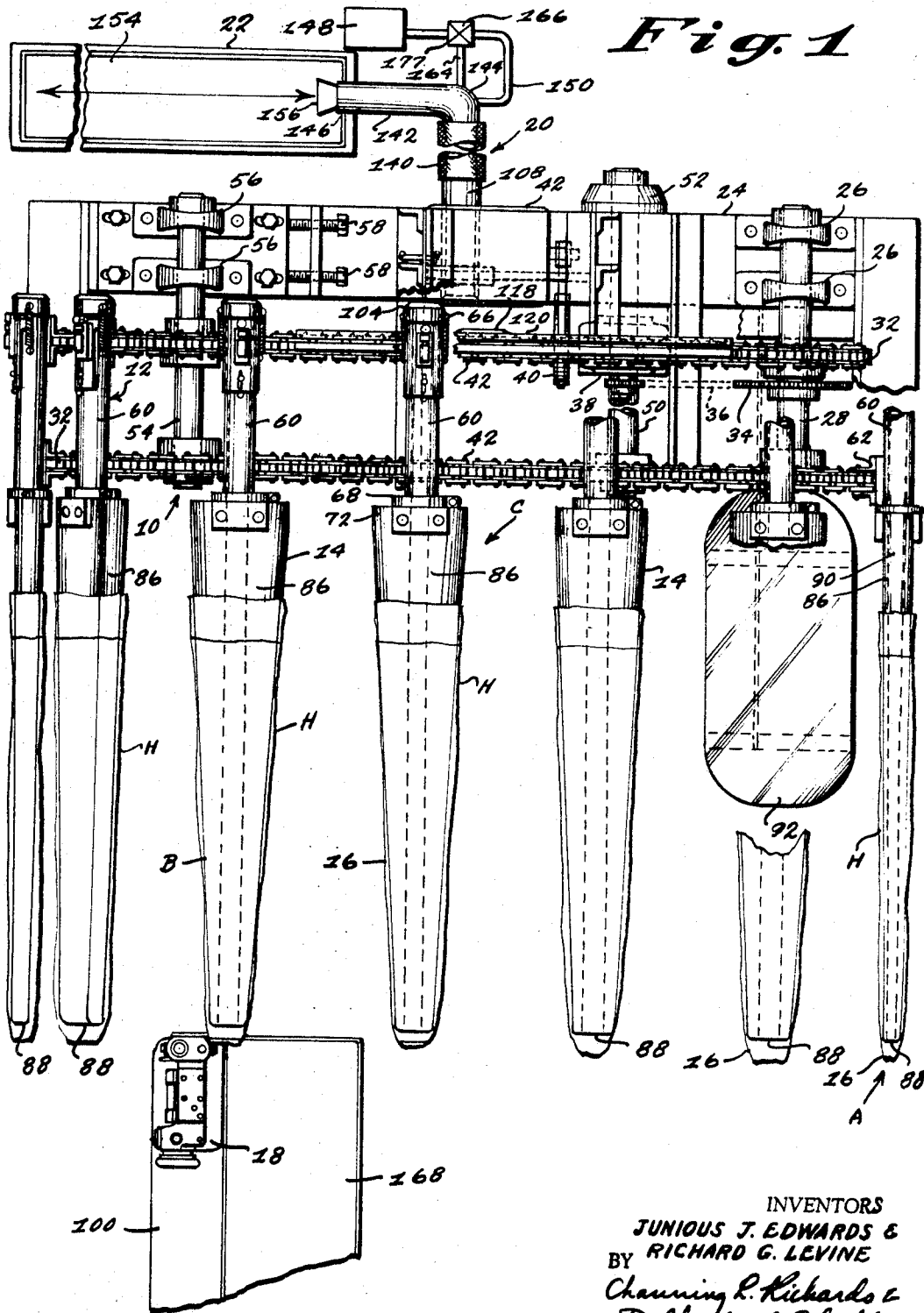
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3,420,196

METHOD AND MEANS FOR PROCESSING TUBULAR ARTICLES

Filed Feb. 3, 1965

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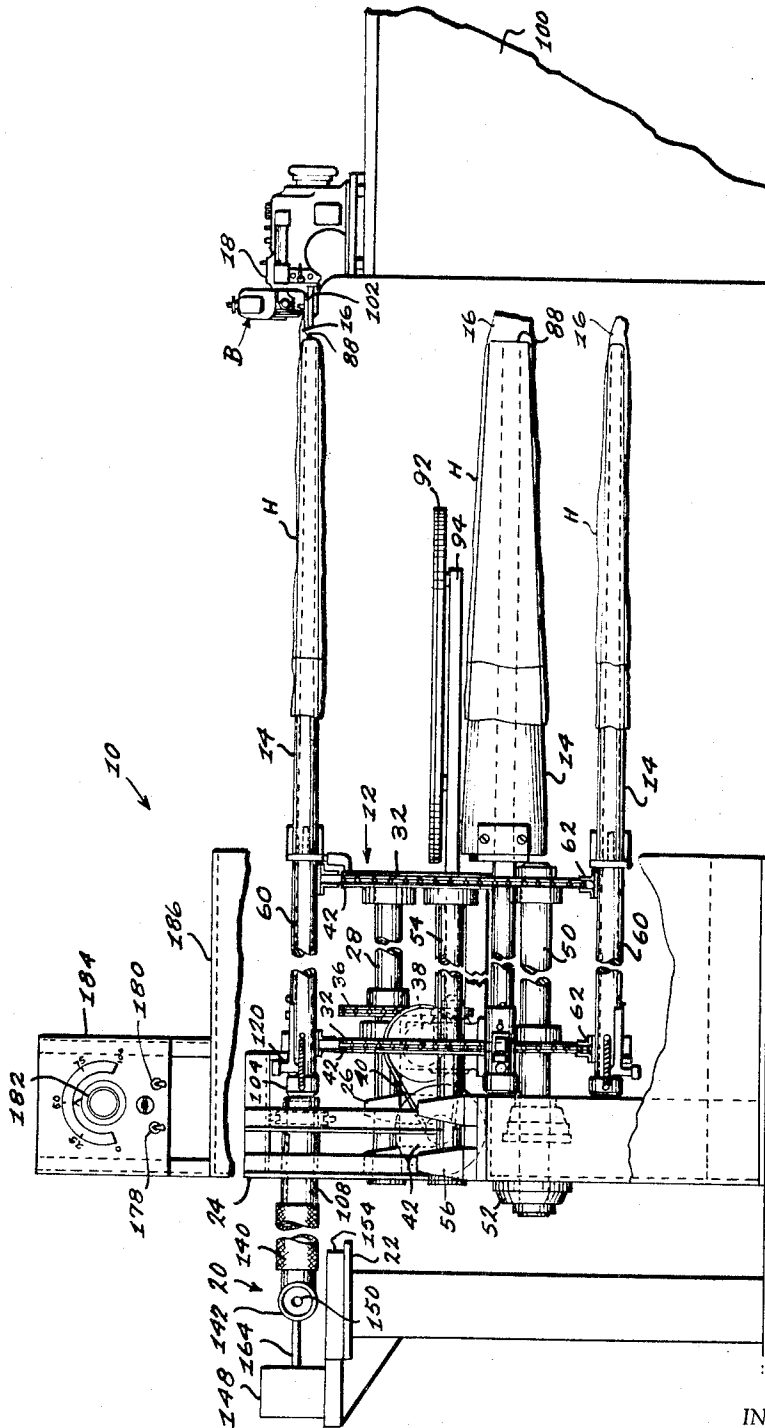
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Fig. 2



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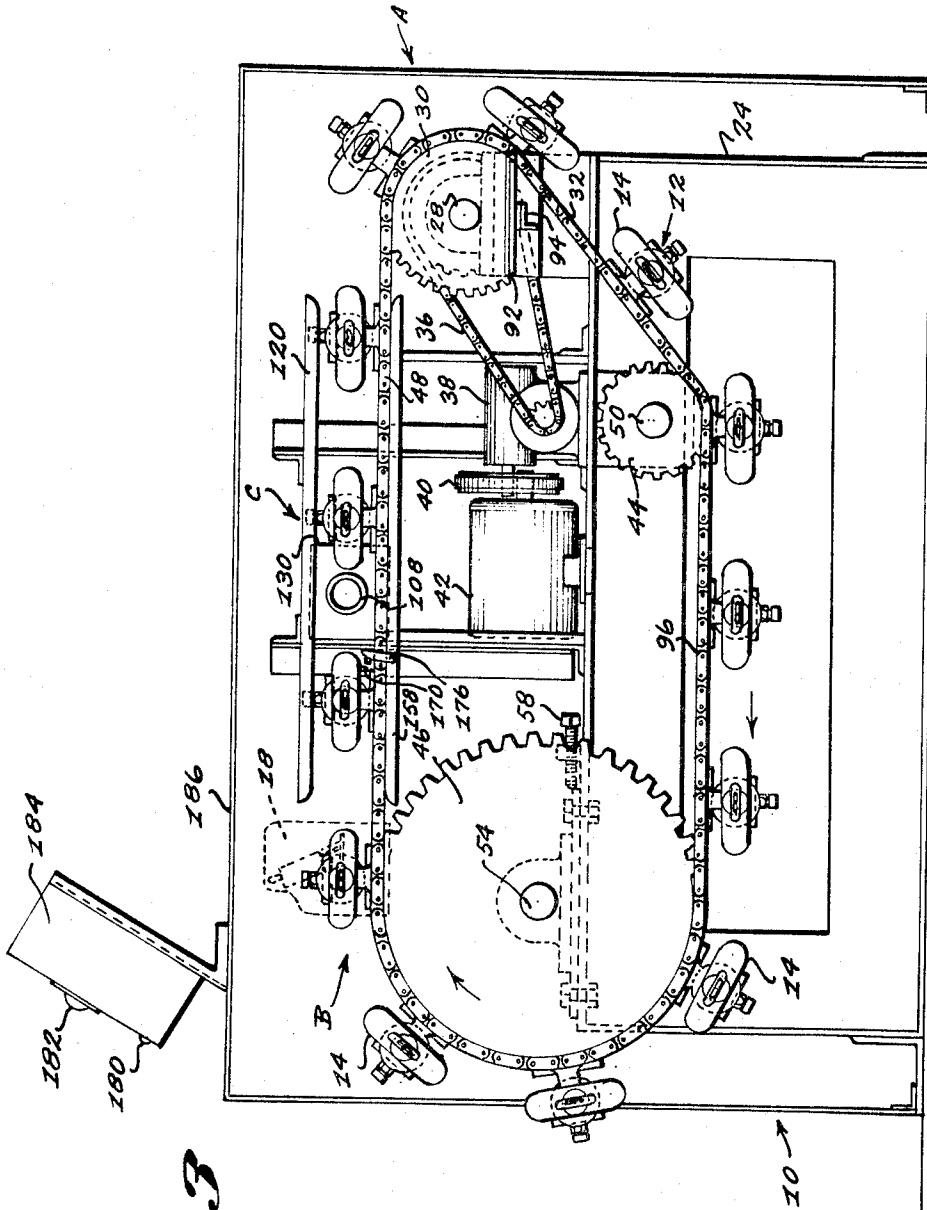


Fig. 3

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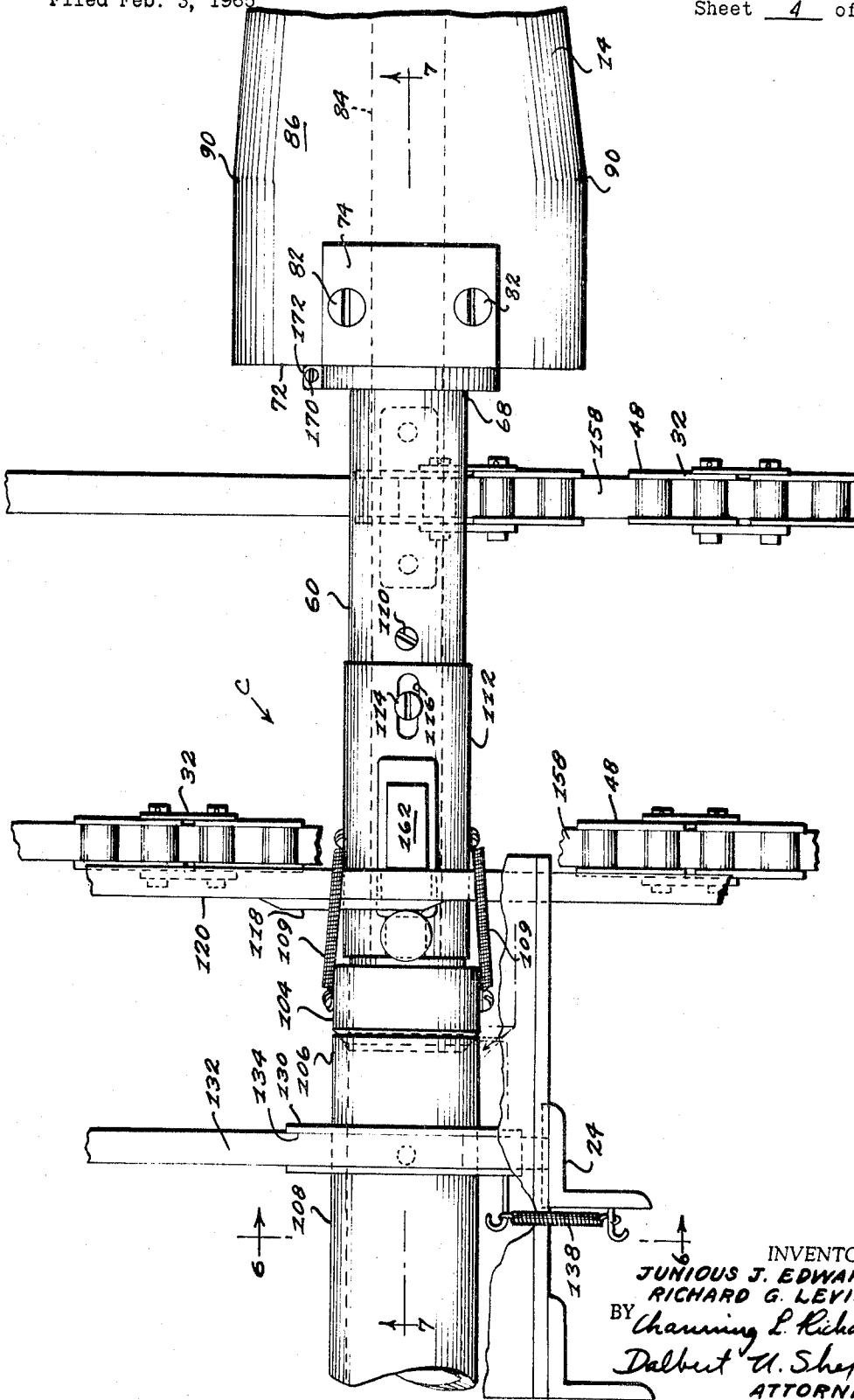


Fig. 4

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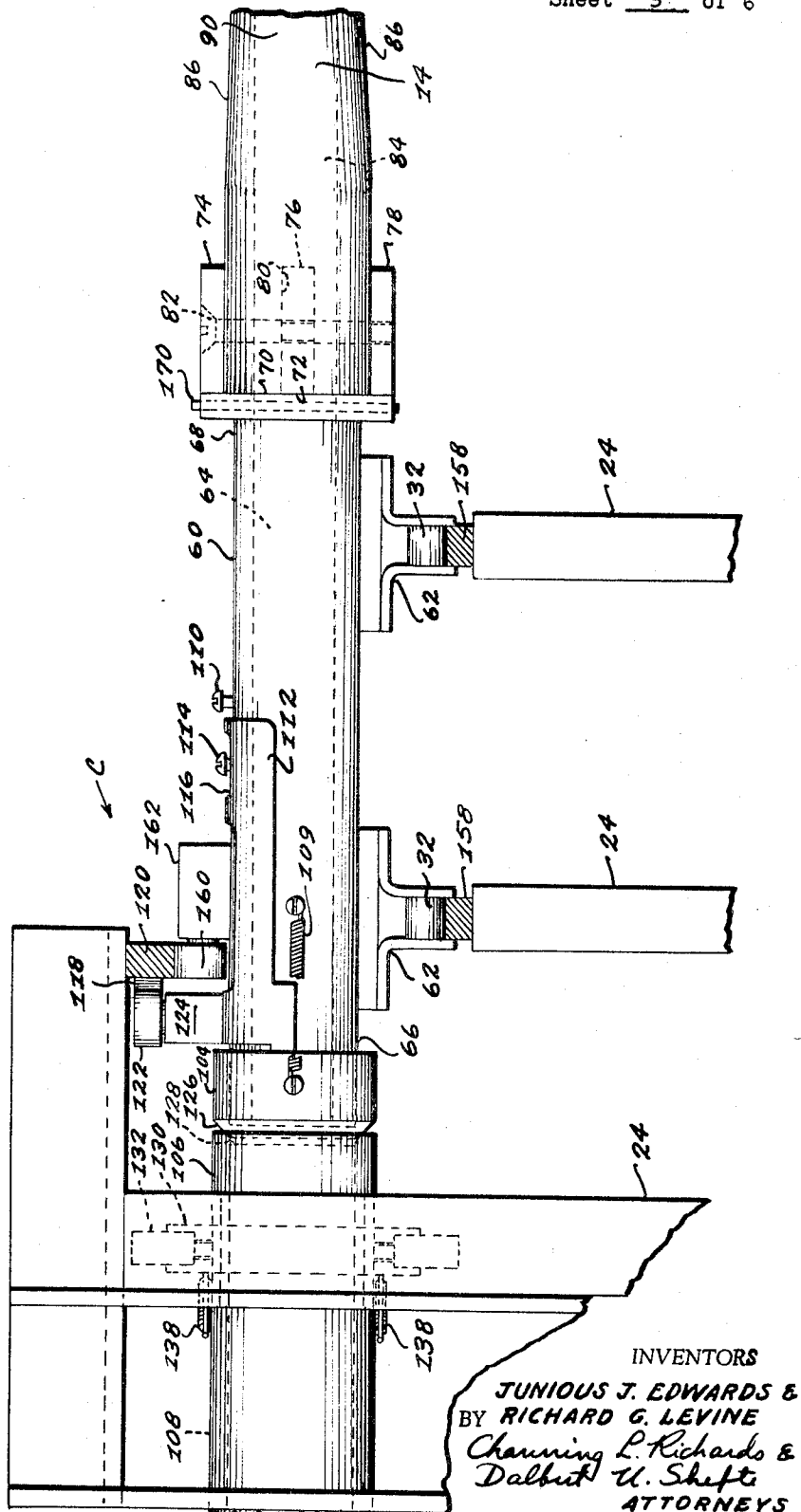
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Fig. 5



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Fig. 7

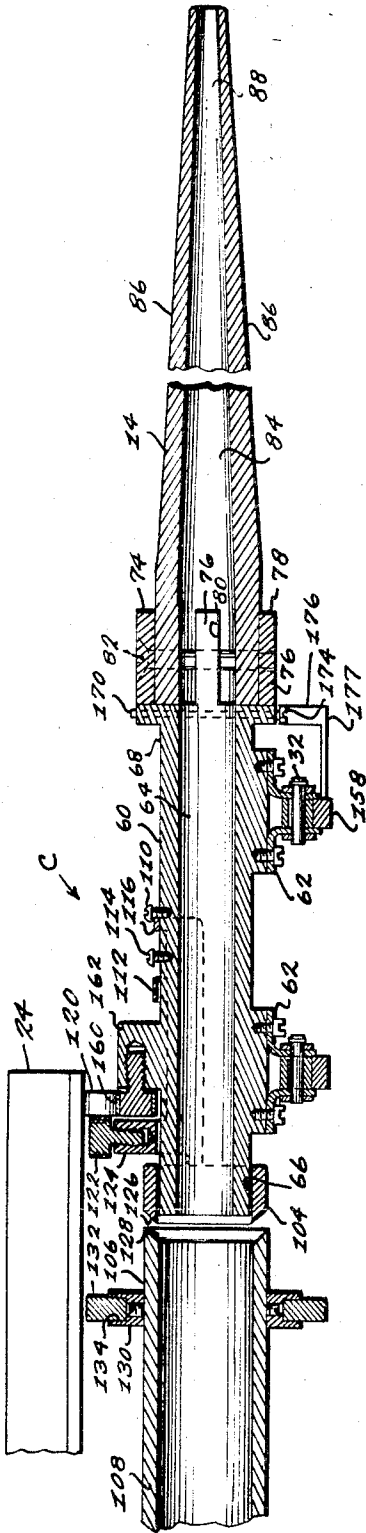
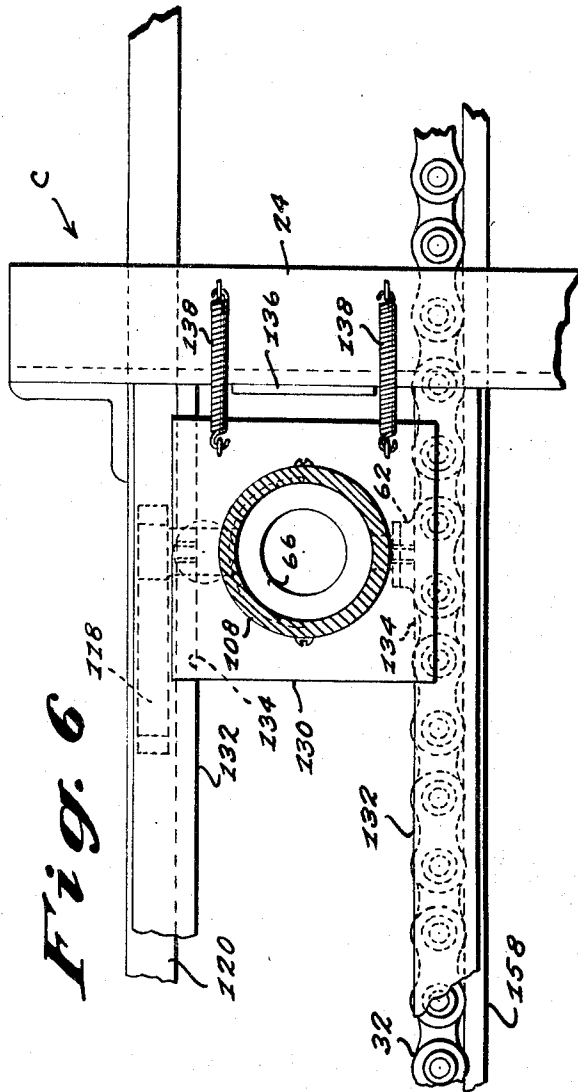


Fig. 6



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METHOD AND MEANS FOR PROCESSING TUBULAR ARTICLES

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13 Claims

Int. Cl. D04b 1/26

ABSTRACT OF THE DISCLOSURE

A method and means for processing tubular fabric articles, such as hosiery, on a plurality of forms that advance sequentially through inspecting, end-closing and everting-removing stations whereby the articles are inspected, their ends are closed, and they are delivered to the everting-removing station without intermediate removal from the forms and with a plurality of articles being in process at the same time.

The present invention relates to a method and means for processing tubular fabric articles in which ends of the articles are closed in an integrated operation that is capable of high-speed production with a compact and simple arrangement that requires only a minimum of handling, which minimizes labor requirements and the danger of damage of the articles during handling.

Briefly described, the method of the present invention involves placing of tubular fabric articles on forms at a receiving station, closing an end of each article while it remains on its form as the form advances through an end closing station, and removing the articles from the forms at a removal station. In addition, the articles may be inspected while they are on the forms at the receiving station without further handling and the articles may be everted as they are removed from the forms after end closing without requiring any further handling between the end closing and everting steps. Thus, an integrated operation is carried out without handling of the articles between steps, and with the different steps being carried out at different stations so that there is no delay at any station while a preceding step is being performed, thereby rendering the invention capable of high-speed production. Preferably, the movement of the forms is continuous with the operations being carried out on the articles as the forms move continuously so as not to slow down the production rate.

This advantageous processing is obtainable by the means of the present invention, which basically comprises conveyor means that convey article carrying forms through the receiving, end closing and removal stations, with the forms arranged for receiving open-ended articles at the receiving station such that open ends of the articles are disposed at the outer ends of the forms for closing of the article ends by closure means in the end closing station while the articles remain on the forms as the forms advance through the end closing station to the removal station at which removal means remove the closed end articles from the forms.

In the preferred embodiment, the means of the present invention is utilized in the manufacture of hosiery to close the toe ends of the tubular fabric articles in an operation integrated with both inspecting and everting of the hosiery article without intermediate handling and with the inspecting, toe closing, and everting being performed at different stations for simultaneous, expeditious production, which is further expedited by continuous movement of the forms on which the articles are carried as the operations are being performed. The forms used in the preferred

embodiment are disposed to extend laterally from a conveyor means for ready access for mounting the hosiery articles thereon and to present the article ends conveniently for horizontal feeding to the closure means, which is preferably a sewing machine disposed adjacent the outer ends of the forms for feeding of the toe ends of the articles therethrough as the forms advance continuously through the end closing station. The hosiery articles are initially mounted on the inspecting and turning forms at the receiving station where they are also inspected for defects, with the use of a mirror for inspecting the opposite sides, if desired. The articles remain on the forms and are not handled again, except for guiding the toes to the sewing machine, until after the toes are closed and the articles are everted and removed from the forms at the removal station. The simultaneous removal and everting is accomplished by pneumatic means that draws the closed toe articles through the hollow interiors of the turning forms, toe end first, and discharges the articles from the opposite ends of the forms as the forms move continuously through the removal station. The pneumatic means may be alternatively operable to eject articles by blowing without turning so that when a defective article is noticed upon inspection that article can be removed at the removal station without everting, the article remaining in unturned condition to facilitate correction of the defect.

The various features and advantages of the present invention are contained in the preferred embodiment described in detail below and illustrated in the accompanying drawings, in which:

FIG. 1 is a plan view, partially broken away, of a hosiery inspecting, toe closing, and everting machine according to the preferred embodiment of the present invention;

FIG. 2 is a side elevation, partially broken away, of the machine of FIG. 1;

FIG. 3 is an end elevation of the machine of FIG. 1;

FIG. 4 is an enlarged fragmentary plan view of the removal station portion of the machine of FIG. 1;

FIG. 5 is an enlarged fragmentary elevation, partially in section, of the removal station portion of FIG. 4;

FIG. 6 is a vertical section taken along line 6—6 of FIG. 4; and

FIG. 7 is a vertical section taken along line 7—7 of FIG. 4.

The illustrated embodiment of the means for processing tubular fabric articles of the present invention is in the form of an integrated hosiery inspecting, toe closing and turning machine 10 having conveyor means 12 that carry hosiery inspecting and turning forms 14 for supporting and carrying hosiery articles H, which are placed on the forms 14 and inspected as the forms are conveyed through a receiving station A. The forms 14 and hosiery H are then conveyed through a toe closing station B at which the open toe ends 16 of the hosiery are closed by the operation of a sewing machine 18, after which the forms 14 advance through a removal station C in which pneumatic means 20 operate to simultaneously evert and remove the closed-toe articles through the forms 14 onto a collection table 22. The empty forms 14 then continue on to the receiving station A ready for receipt of another hosiery article.

The conveyor means 12 is supported on an upstanding frame 24 on which is mounted a pair of laterally spaced bearings 26 that support a horizontal drive shaft 28 in cantilever fashion. The drive shaft 28 has fixed thereon a pair of spaced, vertically disposed, parallel sprockets 30 for driving a pair of parallel endless conveyor chains 32. The drive shaft 28 also carries a drive sprocket 34 that is driven by a drive chain 36 from a reduction unit 38 that is mounted on the frame 24 and is driven by a

belt and pulley connection 40 from a drive motor 42 also mounted on the frame 24.

The conveyor chains 32 are trained over the drive shaft sprockets 30, under a pair of smaller secondary idler sprockets 44 that are beneath the drive shaft sprockets 30, and around a pair of large primary idler sprockets 46 spaced from the drive shaft sprockets 34 to dispose the conveyor chains 32 with a horizontal upper reach 48 between the primary idler sprockets 46 and the drive shaft sprockets 30. The secondary idler sprockets 44 are mounted on a horizontal shaft 50 that is supported in cantilever fashion by a pair of bearings 52 fixed to the frame 24. Similarly, the primary idler sprockets 46 are mounted on a horizontal cantilever shaft 54 mounted in a pair of bearings 56, which bearings are adjustably bolted to the frame 24 and are adjusted by positioning bolts 58 to control the slack in the conveyor chains 32.

The conveyor chains 32 carry a plurality of horizontally disposed tubular carriages 60 that are spaced along the length of the chains 32, with each carriage 60 extending laterally between the conveyor chains 32 and secured thereto by brackets 62. In the embodiment illustrated, there are thirteen such carriages 60 equally spaced on the conveyor chains 32 on the outer surfaces thereof so as not to interfere with the sprockets and to dispose the carriages above the chains along the upper reach 48 thereof.

Each tubular carriage 60 has a hollow interior 64 extending between an inner end 66 adjacent the frame 24 and an opposite outer end 68 having an enlarged outer face 70 for abutment of the inner end 72 of the form 14 thereagainst and having three vertically spaced, outwardly extending attaching flanges 74, 76 and 78, with the upper flange 74 and lower flange 78 disposed for seating of the form 14 therebetween in horizontal laterally extending disposition, and the center flange 76 disposed for seating in a mating recess 80 in the form 14. The form is fixed to the flanges for support by the carriage 60 by bolts 82 passing through the flanges 74, 76 and 78 and intermediate portions of the form 14.

The forms 14 in the embodiment illustrated are similar to conventional hosiery inspection and turning forms, having a hollow interior 84 aligned with the interior 64 of the attached carriage 60 and having relatively wide, flat faces 86 that taper to a narrow outer end 88 and contoured sides 90 connecting the flat faces. This shape facilitates mounting of hosiery H on the forms as hosiery is conventionally formed with a diameter diminishing toward the toe end 16. The substantial flat surface of the faces 86 also facilitates inspection of the hosiery H at the receiving station A. Inspection is further facilitated by the use of a mirror 92 adjustably mounted on a bracket 94 extending from the frame 24 to position the mirror below the upper reach 48 of the conveyor chains 32 at the receiving station A so that an operator may view the side of the hosiery H facing the mirror 92 from outside the path of the forms 14. The mirror 92 may be mounted suitably for pivoted adjustment to provide desired viewing by the particular operator.

The receiving station A is located conveniently at one end of the upper reach 48 of the conveyor chains 32 where the operator can stand in line with the advancing forms 14 and easily slide the hosiery H onto the horizontally extending forms and inspect the hosiery at the same time. The forms then progress along the bottom reach 96 of the conveyor chains 32 and up around the primary idler sprockets 46 to the toe closing station B, which is also conveniently located adjacent an end of the upper reach 48 of the conveyor chains 32.

Located in the toe closing station is the sewing machine 18 mounted on a table 100 and having a work plate 102 extending horizontally closely adjacent the path of the outer ends 88 of the forms 14 and in generally the same horizontal plane. The feed of the sewing machine 18 is generally parallel with the direction of movement of the

forms 14 so that the toe ends 16 of the hosiery H may be fed to the sewing machine 18 to close the toes as the forms 14 progress through the toe closing station B. However, a slight inclination of the sewing machine feed in a horizontal plane may be desirable to impart a desired taper to the closed toe.

The forms 14 and closed toe hosiery H advance from the toe closing station B along the upper reach 48 of the conveyor chains 32 to the removal station C at which the closed toe hosiery H is simultaneously removed and everted by suction through the hollow interiors 84 of the forms 14, toe ends 16 first. The suction for removing and everting is provided by the pneumatic means 20 that engages the inner ends 66 of the form carrying carriages 60 sequentially as the carriages advance continuously through the removal station C.

Connection of the carriages 60 to the pneumatic means during continuous advance of the carriages is accomplished by shiftable annular collars 104 carried on the inner ends 66 of the carriages to extend the effective length of the carriages into seating disposition in the outer end 106 of the connecting conduit 108 of the pneumatic means 20. The annular collars 104 are normally retained in retracted conduit clearing position (FIGS. 1, 2 and 7) by coil springs 109 on each side of the carriages and having their ends secured to the carriages 60 and collars 104 with the retraction limited by stop screws 110 projecting from the carriages 60 for abutment by cylindrical flanges 112 extending along the carriages from the collars 104. The collars 104 and attached flanges 112 are retained against rotation on the carriages 60 and are limited in projection by additional stop screws 114 secured to the carriages 60 and accommodated in longitudinal slots 116 in the flanges 112.

Projection of the collars 104 into seating disposition in the connecting conduit end 106 is accomplished by a cam 118 mounted on a bar 120 depending from the frame 24 through the removal station C above the collar flange 112 location. The cam 118 faces the connecting conduit 108 and is engaged by cam following rollers 122 mounted for free rotation about vertical axes in blocks 124 projecting upward from the flanges 112. Each roller 122 normally rides on the side of the bar 120 as its carriage 60 approaches the cam 118 and then it rides on the cam to project the collar 104 into connecting engagement with the conduit 108, with the cam 118 contoured to project the tapered outer surface 126 of the collar 104 from the retracted position shown in dot-dash lines in FIG. 4 into seating engagement in the mating inwardly tapered surface 128 of the conduit outer end 106, also shown in dot-dash lines in FIG. 4, in the direction of the arrow in FIG. 4. The cam 118 is further contoured to retain this seating engagement as the carriage 60 progresses a short distance and then to release the collar 104 to permit it to retract out of conduit engagement.

The connecting conduit 108 is adapted for sliding movement upon engagement by the carriage collars 104 by being mounted in an upstanding slide plate 130 that is positioned between a pair of vertically spaced guide strips 132 extending parallel to the path of movement of the carriages 60, with the guide strips 132 engaging grooves 134 along the top and bottom edges of the slide plate 130 to retain and guide the plate for sliding parallel to the path of movement of the carriages 60. The guide strips 132 are fixed to the frame 24, which also supports a vertical stop block 136, preferably of resilient material, in line with the slide plate 130 and against which the plate is normally retained by a pair of coil springs 138 extending between the slide plate 130 and the frame 24 adjacent the stop block 136.

With this arrangement, the cam 118 will cause the carriage collar 104 of the approaching carriage 60 to engage the connecting conduit 108 and cause it to travel with the carriage until the collar is retracted at the end of cam

engagement, at which time the collar disengages the conduit, permitting the springs 138 to pull the plate 130 back to its initial stopped position against the stop block 136 in readiness for engagement of the conduit 108 by the collar 104 of the next approaching carriage 60.

The carriages 60 are maintained in alignment with the connecting conduit 108 for proper collar and conduit engagement by a pair of horizontally extending support beams 158 attached to the frame 24 and extending in supporting relation under the conveyor chains 32 through the removal station C, and by the aforementioned cam supporting bar 120, the underside of which is engaged by rollers 160 mounted for free rotation about horizontal axes in upstanding blocks 162 mounted on the carriages 60.

The connecting conduit 108 extends away from the slide plate 130 and is connected to an end of a flexible conduit 140, the other end of which is connected to a discharge conduit 142 having an intermediate elbow portion 144 and a discharge end 146.

Suction is created in the connecting conduit 108 for drawing of hosiery H through the forms 14 when the carriage 60 is connected to the conduit by projection of the collar 104 by an air compressor 148 that blows air through a main line 150 into the elbow portion 144 of the discharge conduit 142 in the direction of the discharge end 146 thereof, which creates a suction in the connecting conduit 108 and in the interior of the form 14 during the period of collar connection with the connecting conduit.

The air compressor 148 is mounted on the collection table 22, which also supports a hosiery receiving tray 154 under the discharge end 146 of the discharge conduit 142 to receive hosiery H blown therefrom. To control the discharge of the hosiery, means 156 (shown diagrammatically in FIG. 1) of any well-known conventional construction may be utilized.

When a defective hosiery article is detected upon inspection at the receiving station A, it is usually desirable to segregate the defective article from the others upon removal and to remove the defective article without turning. This is accomplished in the present invention by a secondary air line 164 connected to the main line 150 by a valve 166 and opening into the discharge conduit elbow portion 144 in the direction of the connecting conduit 108 so that when the valve is operated air will be blown through the secondary line 164, connecting conduit 108, carriage 60 and form 14 to blow defective hosiery onto a receiving tray 168 on the sewing machine table 100 in line with the location of the forms in the removal station C.

Operation of the valve 166 may be controlled by any suitable memory system to effect operation of the valve 166 when a previously detected defective article is positioned for removal. By way of example, the illustrated embodiment utilizes a depressible pin 170 held by friction in a bracket 172 at the outer end 68 of each carriage 60. When the pin 170 is depressed by the operator to indicate that a defective article is on the particular form, the pin will contact a valve operating switch 172 mounted on a bracket 176 (FIGS. 2, 3 and 7) attached to the outer support beam 158 immediately in advance of conduit engagement by the collar 104 of the appropriate carriage 60 to operate the valve 166 through the electrical lead line 177 to momentarily blow air through the form for discharge of the defective hosiery onto the receiving tray 168 on the sewing machine table 100. The switch bracket 176 is upwardly contoured beyond the switch 174 to raise the depressed pins 170 to their initial position out of switch contacting disposition.

To operate the machine 10 of the illustrated embodiment, two operators are required, one at the receiving station A and one at the toe closing station B. The machine is started by closing a drive motor switch 178 that

turns on the drive motor 42 to cause continuous movement of the carriages 60 and associated forms 14, and by closing a compressor switch 180 that turns on the compressor 148 to create a continuous suction in the connecting conduit 108. A reostat 182 or other suitable variable control is set at a selected speed indication to provide a desired rate of travel of the forms 14. These switches 178 and 180 and the reostat 182 are mounted on a control panel 184 on the top of a protective housing 186 over the conveyor means elements of the machine.

The receiving station operator places hosiery articles H on the advancing forms 14 with the toe ends 16 of the articles at the outer ends 88 of the forms, and inspects the articles for defects, using the mirror 92 to inspect the portions of the articles on the opposite face of each form. Upon detecting a defect, the operator depresses the pin 170.

Simultaneous with the activity of the receiving station operator, the toe closing station operator places the toe ends 16 of the hosiery articles 14 in proper position on the sewing machine work plate 102 for feeding of the toe ends 16 through the sewing machine 18 to close the toes as the forms 14 move continuously past the sewing machine.

While the receiving station operator is continuously placing hosiery on the forms and inspecting the hosiery, and while the toe closure station operator is continuously feeding hosiery toe ends 16 to the sewing machine 18, the carriages 60 are sequentially engaging the connecting conduit 108 of the pneumatic means through the shiftable collars 104 (FIG. 4) to carry the conduit with it for a short distance to remove the articles from the forms 14 and evert them through the forms and out of the discharge conduit 142 onto the tray 154, after which the connecting conduit 108 is released to return to its initial position for pick-up by the next carriage 24 as the empty forms 16 are conveyed to the receiving station A to receive another article. When a defective article has been indicated by depressing the pin 170, the pin will, when its carriage approaches the conduit engaging position, close the switch 174 to operate the valve 166 to cause the defective article to be blown from the form without everting.

Periodically the receiving trays 154 and 168 are replaced or, alternatively, conveyor means may be utilized, with or without the trays, to receive the articles and convey them to the next processing station.

The above-described machine 10 is illustrative of one application of the features of the present invention, but the invention is not intended to be limited to the described details. For example, the principles could be applied to processing various types of tubular fabric articles other than hosiery; closure means, such as heat sealing devices and other means, could be used instead of a sewing machine to close the ends of the articles; other types of removing means may be used to remove the articles from the forms in place of the described pneumatic means and the connecting details may be varied, as, for example, by mounting the shiftable collar 104 on the connecting conduit 108 rather than on the carriages 60; and various other substitute arrangements for accomplishing the same purposes may be utilized without departing from the intended scope of the present invention, which is not intended to be limited except as defined in the appended claims.

We claim:

1. A method of processing tubular fabric articles, such as hosiery, said method comprising continuously advancing a plurality of article carrying forms in an endless path through an inspection station, an end closing station and a removal station, placing tubular fabric articles individually on said continuously advancing forms and inspecting for defective articles on said forms as the forms advance through said inspecting station, closing an end of each inspected tubular fabric article, such as the toe

end of hosiery, while the article remains on the form as the forms advance through said end closing station, simultaneously everting and removing said articles from said forms as said forms advance continuously through said removal station while removing defective articles without everting.

2. A method of processing tubular fabric articles, such as hosiery according to claim 1 and characterized further in that said toe closing is accomplished by sewing the ends of the articles, such as the toe ends of hosiery, to form a closed seam thereat.

3. A method of processing tubular fabric articles in the manufacture of hosiery, said method comprising continuously advancing a plurality of hosiery inspecting and turning forms in an endless path through an inspecting station, a toe closing station and a removal station, placing tubular fabric articles having open toe ends individually on said inspecting and turning forms with the open toe ends at the outer ends of the forms and inspecting the individual articles on the forms for defective articles as the forms advance through the inspecting station, closing the toe ends of said inspected articles while the articles remain on the forms as the forms advance continuously through said toe closing station, and simultaneously everting and removing the closed toe articles through the inspecting and turning forms as said forms advance through said removal station while removing defective articles from the outer ends of the forms without everting.

4. Means for processing tubular fabric articles, such as hosiery, said means comprising a plurality of article carrying forms, conveyor means for conveying said forms through receiving, end closing and removal stations with said forms having outer ends extending from said conveyor means for receiving open-ended tubular fabric articles thereon as the forms are conveyed through said receiving station, closure means at said end closing station adjacent the outer ends of said forms for engagement of the open ends of articles, such as the toe ends of hosiery, to close the ends while the articles remain on the forms as they are conveyed through said end closing station, removal means at said removal station for removing said closed end articles from said forms as the forms are conveyed through said removal station, and a mirror mounted in said receiving station and facing the forms for inspection from the opposite side of the forms of the surface of the articles adjacent said mirror.

5. Means for processing tubular fabric articles, such as hosiery, said means comprising a plurality of hollow turning forms, conveyor means for conveying said forms through receiving, end closing and removal stations with said turning forms having outer ends extending from said conveyor means for receiving open-ended tubular fabric articles thereon as the forms are conveyed through said receiving station at which defective articles are detected, closure means at said end closing station adjacent the outer ends of said forms for engagement of the open ends of articles, such as the toe ends of hosiery, to close the ends while the articles remain on the forms as they pass through said end closing station, pneumatic means engageable with the other ends of said hollow forms as they are conveyed through said removal station to create suction in the hollow interiors of said forms for simultaneously removing and everting said articles from the outer ends of the forms through the hollow interiors, said pneumatic means being selectively operable to blow air through said hollow interiors of the forms and out the outer ends thereof to remove defective articles from said forms without everting.

6. Means for processing tubular fabric articles in the manufacture of hosiery, said means comprising a plurality of hosiery supporting forms, means for conveying said forms through receiving, toe closing and removal stations, with the forms supported on said conveyor means in horizontal disposition and having outer ends extending later-

ally therefrom for ready access at said receiving and toe closing stations, said forms receiving open-ended hosiery articles thereon as the forms are conveyed through the receiving station with the open toe ends of the hosiery articles at the outer ends of the forms, said conveying means conveying said forms through said toe closing station in a horizontal path, a sewing machine at said toe closing station adjacent the outer ends of said forms for engagement of the toe ends of the hosiery articles to close the toes while the articles remain on the forms as they are conveyed through said toe closing station, said sewing machine being disposed for horizontal feeding of said hosiery article toe ends therethrough in the same general direction as the advance of the forms through said closing station, and removal means at said removal station for removing said closed toe hosiery articles from said forms as the forms are conveyed through said removal station.

7. Means for processing tubular fabric articles in the manufacture of hosiery, said means comprising a plurality of hosiery supporting forms, means for conveying said forms through receiving, toe closing and removal stations, with the forms supported on said conveyor means in horizontal disposition and having outer ends extending laterally therefrom for ready access at said receiving and toe-closing stations, said conveying means conveying said forms in an endless path that has an upper reach and a lower reach with said receiving and toe-closing stations disposed adjacent opposite ends of said upper reach, said forms receiving open-ended hosiery articles thereon as the forms are conveyed through the receiving station with the open toe ends of the hosiery articles at the outer ends of the forms, closure means at said toe closing station adjacent the outer ends of said forms for engagement of the toe ends of the hosiery articles to close the toes while the articles remain on the forms as they are conveyed through said toe closing station, and removal means at said removal station for removing said closed toe hosiery articles from said forms as the forms are conveyed through said removal station.

8. Means for processing tubular fabric articles in the manufacture of hosiery according to claim 7 and characterized further by a mirror disposed at said receiving station between said upper and lower reaches of said endless path and facing the forms in said receiving station for inspection of the portions of the articles adjacent the mirror from outside the endless path.

9. Means for processing tubular fabric articles in the manufacture of hosiery according to claim 7 and characterized further in that said conveying means comprises a pair of horizontally spaced, parallel form supporting members arranged for synchronous movement in vertical planes, said forms being supported on and extending laterally between said members with the outer ends of said forms extending horizontally from one of said members, and said removal means being disposed adjacent the other of said members.

10. Means for processing tubular fabric articles, such as hosiery, said means comprising a plurality of hollow turning forms, conveyor means for conveying said forms through receiving, end closing and removal stations with said turning forms having outer ends extending from said conveyor means for receiving open-ended tubular fabric articles thereon as the forms are conveyed through said receiving station, closure means at said end closing station adjacent the outer ends of said forms for engagement of the open ends of articles, such as the toe ends of hosiery, to close the ends while the articles remain on the forms as they pass through said end closing station, pneumatic means engageable with the other ends of said hollow forms as they are conveyed through said removal station to create suction in the hollow interiors of said forms for simultaneously removing and everting said articles from the outer ends of the forms through the hollow interiors, said pneumatic means including a suction conduit having a slidably mounted end sequentially engageable with said

other ends of said forms for movement therewith as said forms are conveyed through said removal station.

11. Means for processing tubular fabric articles, such as hosiery, according to claim 10 and characterized further by shiftable collars carried with said forms and shiftable into engagement with said slidably mounted conduit end to connect said conduit end to said form for movement therewith at said removal station.

12. Means for processing tubular fabric articles, such as hosiery, according to claim 11 and characterized further by cam means at said removal station and engageable with said shiftable collars to project said collars into conduit engagement and thereafter to retract said collars for disengagement of said conduit end.

13. Means for processing tubular fabric articles, such as hosiery, according to claim 11 and characterized further in that said shiftable collars have tapered surfaces engageable in said conduit end to connect said conduit end for movement therewith.

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